

Supplementary material

Table 1. Correspondence between nature contributions (NCP), ecosystem services (ES) and their connection with human wellbeing

Statement	NCP category	Type of ES	Benefit	Human wellbeing dimension to which ecosystem service contributes	Ecosystem service Scale	Human wellbeing Scale	Effect	Source	
								Literature of ES	Interview
Agrarian soils are important because they offer a relaxing and leisure space: for walks, birds tourism	Non-material Inspiration; physical and psychologic al experiences Supporting identities	Outdoo r recreation	Activity	Subjective happiness Solastalgia (distress by environment)	Landscap e	Individual	Direct	(Calvet-Mir et al., 2012; Klain et al., 2014; MEA, 2005a; Swinton et al., 2007)	✓
Agrarian soils are important because they offer unique and attractive landscapes	Non-material Inspiration; physical and psychologic al experiences Supporting identities	Outdoo r recreation	Aesthetic	Subjective happiness Solastalgia (distress by environment)	Landscap e	Collectiv e /Individual	Direct	(De Groot et al., 2002; Kremen, 2005; MEA, 2005a; Swinton et al., 2007; Zhang et al., 2007)	✓
Agrarian soil is important because it offers an inspiration source (art, culture...)	Non-material Inspiration; physical and psychologic	Artistic	Inspiratio n	Subjective happiness Solastalgia (distress by environment)	All	Individual	Direct	(Calvet-Mir et al., 2012; Klain et al., 2014; MEA, 2005a)	✓

	al experiences								
Agrarian soil is important because it offers an ideal source of education (about natural cycles etc.)	Non-material Inspiration; physical and psychological experiences	Education and cognitive development	Knowledge	Subjective happiness Affection and respect: being part of environment Freedom to choose	All	Collective /Individual	Direct	(Calvet-Mir et al., 2012; K. Chan et al., 2012; MEA, 2005a)	✓
Agrarian soil is important because it keeps and exposes traditional land activities, there is a culture, richness and knowledge	Non-material Supporting identities	Education through traditional knowledge	Knowledge and identity	Subjective happiness Affection and respect: we are part of environment; Social relations Mutual respect; Ability to help others	Landscape	Collective /Individual	Direct	(Calvet-Mir et al., 2012, MEA, 2005b)	✓
Agrarian soil is important because it creates social relations	Non-material Inspiration; physical and psychological experiences	Place for creating and enhancing social relations	Social capital and cohesion	Social relations Social cohesion; Mutual respect; Ability to help others	Landscape	Collective /Individual	Direct	(Calvet-Mir et al., 2012;	✓
Agrarian soil is important because it makes you surpass yourself, it	Non-material Inspiration; physical	Self-fulfilment	Spiritual and identity	Freedom to choose	Plot	Individual	Direct		✓

is constructive, it gives illusion and strength to keep working	and psychological experiences Supporting identities								
Soil quality is important since food quality depends on it	Non-material Inspiration; physical and psychological experiences Supporting identities	Food quality	Material	Health Access to clean food and water	Plot & landscape	Individual	Direct	(Calvet-Mir et al., 2012)	✓
Agrarian soil is important although not essential since technology makes possible crops without soil	Material Food and feed	Food	Material	Basic material for good life & Security Food; Access to goods	Plot & landscape	Collective & Individual	Direct	(De Groot et al., 2002b; MEA, 2005a; Swinton et al., 2007; Zhang et al., 2007)	✓
Agrarian soil is important because it provides with raw materials for industry and cattle	Material Food and feed	Raw material	Material	Basic material for good life & Security Access to goods	Plot & landscape	Collective & Individual	Direct	(De Groot et al., 2002b; MEA, 2005a)	✓
Agrarian land is important because it captures CO ₂ and it helps to mitigate climate change	Regulating Regulation of climate	Climate regulation	Existence / Option	Security Secure resource access; Security from disasters	All scales	Collective	Indirect	(De Groot et al., 2002b; Kremen, 2005; MEA, 2005a; Weber, 2007; Zhang et al.,	✓

								2007)	
It is important when there are insects in the agrarian soil because of their biological regulation function. They contribute to balance in the system	Regulating Regulation of detrimental organisms and biological processes	Biological regulation	Existence / Option	Security & Health Secure resource access (clean food and water); Security from disasters	Microscopic	Collective & Individual	Direct	(Barrios, 2007; Daily, 1997; De Groot et al., 2002b; Kremen, 2005; MEA, 2005a; Sandhu et al., 2010; Weber, 2007; Zhang et al., 2007)	✓
Many agrarian soil cannot filtrate water properly and they don't help on water quantity regulation	Regulating Regulation of freshwater quantity, location and timing	Water quantity regulation	Existence / Option	Security Secure resource access; Security from disasters	Plot	Collective & Individual	Direct	(Barrios, 2007; De Groot et al., 2002b; Kremen, 2005; Lavelle et al., 2006; MEA, 2005a; Sandhu et al., 2010; Zhang et al., 2007)	✓
Agrarian soil is important because it acts as a filter that cleans water, and contributes necessary salts	Regulating Regulation of freshwater and coastal water quality	Water quality regulation	Existence / Option	Security & Health Secure resource access (clean food and water); Security from disasters	Plot	Collective & Individual	Direct	(Kremen, 2005; MEA, 2005a; Swinton et al., 2007; Weber, 2007; Zhang et al., 2007)	✓
Agrarian soil is important because it regulates the erosion caused by	Regulating Formation, protection and	Erosion prevention	Existence / Option	Security Secure resource access; Security from disasters	Plot & landscape	Collective & Individual	Indirect	(Barrios, 2007; De Groot et al., 2002b; Kremen, 2005;	✓

water	decontamination of soils and sediments							Lavelle et al., 2006; MEA, 2005a; Sandhu et al., 2010)	
Agrarian soil is important because it absorbs wastes that otherwise may be problematic	Regulating Formation, protection and decontamination of soils and sediments	Pollutant regulation	Existence / Option	Security & Health	Plot & landscape	Collective & Individual	Indirect	(Calvet-Mir et al., 2012; Daily, 1997; De Groot et al., 2002b; Kremen, 2005; MEA, 2005a)	✓
Agrarian soil is important because it supports terrestrial life	Regulating Habitat creation and maintenance	Life	Material / Existence / Option	Security & Basic material for life	All	Collective & Individual	Direct	(Turner and Daily, 2008)	✓
Agrarian soil is important because it is a shelter for fauna	Regulating Habitat creation and maintenance	Habitat	Material / Existence / Option	Security & Basic material for life	Landscape	Collective & Individual	Direct	(De Groot et al., 2002b; MEA, 2005a; Weber, 2007)	✓
Agrarian soil is important because its nutrients make possible the crops	Regulating Pollination and dispersal of seeds and other propagules Regulation	Fertility	Existence / Option	Security & Basic material for life	Plot & landscape	Collective & Individual	Direct	(Calvet-Mir et al., 2012; Kremen, 2005; MEA, 2005a)	✓

	of detrimental organisms and biological processes Maintenance of options								
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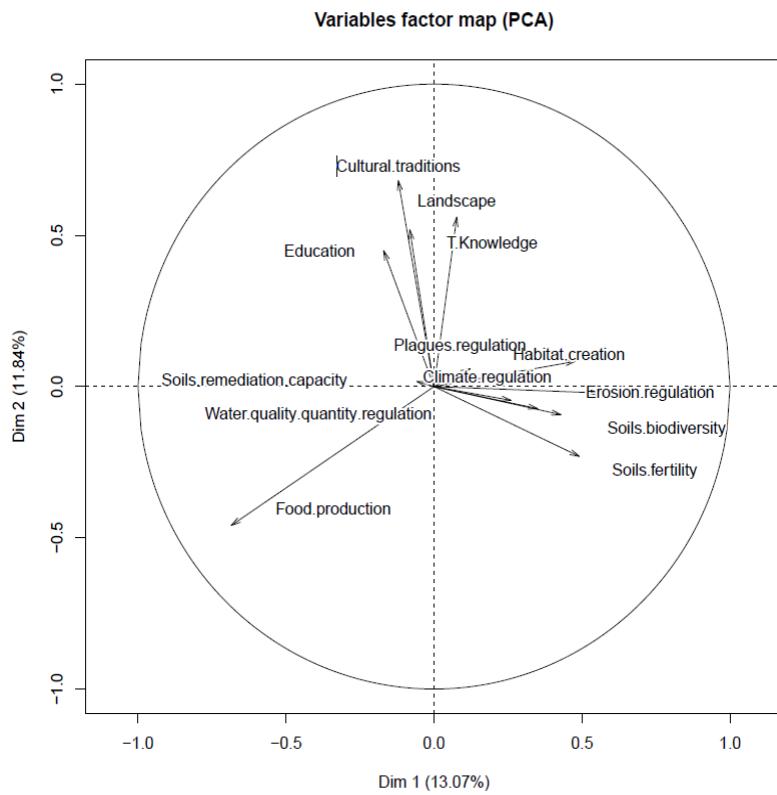


Fig 1. Principal Component Analysis (PCA) of farmers' elicited values about NCP¹

Table 2. Factor loadings of the PCA

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
Food.production	-0.68507	-0.45918	0.233832	0.039682	0.019769
Water.quality.quantity.regulation	0.260141	-0.04565	-0.18836	-0.60423	-0.45665
Climate.regulation	0.559867	-0.02112	0.006602	-0.05236	-0.32822
Plagues.regulation	0.476441	0.083043	0.099485	-0.07499	0.450088
Erosion.regulation	0.34984	-0.07283	0.081491	0.49209	-0.38688
Soils.remediation.capacity	-0.05791	0.016987	-0.59281	0.254316	0.305165
Soils.biodiversity	0.428815	-0.09287	0.50737	-0.08476	0.329634
Habitat.creation	0.12228	0.059083	0.637002	-0.03581	0.144404
Soils.fertility	0.490882	-0.23092	-0.3458	0.134349	0.119724
Education	-0.17023	0.449296	0.250718	0.076596	-0.36788
Cultural.traditions	-0.12078	0.680747	0.060012	-0.08348	0.049629
T.Knowledge	-0.08175	0.518187	-0.23261	-0.3892	0.211526
Landscape	0.076795	0.560432	0.005929	0.493622	-0.0318
Eigenvalue	1.70	1.54	1.36	1.12	1.09
Variability (%)	13.07	11.84	10.47	8.59	8.38
Cumulative variability (%)	13.07	24.91	35.38	43.97	52.35

¹ NCP have been simplified for a better visualization

I. Template for the first round of semi-structured interviews²

The study encompasses diverse views about land ecosystem services for human wellbeing and how such values are influenced by modern irrigation. The information obtained from the interviews will be used confidentially. Personal information is only retained for potential follow-up procedures in the future, if necessary. The interview lasts approximately one and a half hours. I ask for your permission to record the interview. Thank you.

Interview number:	Sector:	Place:
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Following questions includes only the introductory questions since this article is part of a broader project

Could you please tell me?

1. Your name and birth year (I also indicated gender):
2. Literacy level of number of years studied:
3. Your profession:
4. How do you connect your work to the agrarian sector?
5. How long have you been working in the agrarian sector?
6. How would you classify farmers in this area?
7. Could you tell me four types of agrarian practices common in the area?
8. Which are the services or benefits that the agrarian ecosystem provides you with?
How would you relate such benefits with your wellbeing and/or wellbeing in general (for the whole society)³?
9. How happy would you say you are regarding your livelihood? Why?

Please tell me your opinion about the questions; what would you change and why?

Who else would you suggest to speak with?

² Though the interviews were conducted in Spanish, We are publishing the final questions as translated to English. If interested in reviewing the originals, they are available via the author.

³ Farmers were encourage to think why they had chosen such profession, what (beyond the crop) was the ecosystem providing them with

II. Participants in the first round of interviews

The following Table describes the participants' profiles of the first-round interviews. Listed first are diverse farmers, followed by mixed stakeholders' profiles. Farmers were selected according to time invested in agriculture, type of crops, management approach, gender and age. 'Other' stakeholders were selected in relation to their involvement within the transformation to modern irrigation.

	Age	Gender	Area/zone	Profile	Land management system (If applicable)
I.1	Middle	Female	Southern Zone	Part-time; cereal ecologic system	Rainfed
I.2	Middle	Male	Medium area	Full-time; wine farm/vineyard	Irrigated and rainfed
I.3	Young	Male	Northern area	New farmer	Irrigated and rainfed
I.4	Middle	Male	Northern area	Full time	Irrigated and rainfed
I.5	Middle	Male	Northern area	Full time	Irrigated and rainfed
I.6	Old	Male	Northern area	Full time	Cooperative president
I.7	Middle	Male	Northern area	Part time	Irrigated system without installation
I.8	Middle	Male	Southern area	Full time	Irrigated
I.9	Old	Male	Southern area	Retired	Small plot
I.10	Middle	Female	Medium area	Part time	Rainfed
I.11	Middle	Female	Medium area	Part time	Traditional irrigated system
I.12	Middle	Male	Southern area	Full time	Conventional and ecological farming under irrigated and rainfed systems
I.13	Young	Female	n/a	n/a	Technician of AguaCanal
I.14	Middle	Male	n/a	n/a	Responsible of lands concentration of INTIA
I.15	Middle	Female	n/a	n/a	Responsible of agrarian farms training of INTIA
I.16	Middle	Male	n/a	n/a	Responsible of Projects and direction of canal work
I.17	Middle	Male	n/a	n/a	Head of agricultural production (I+D) of INTIA
I.18	Middle	Male	n/a	n/a	Technician of the negotiated of soils and climatology of Navarre Government
I.19	Middle	Male	n/a	n/a	Head of re-parceling negotiation

	Age	Gender	Area/zone	Profile	Land management system (If applicable)
					of Rural development and environment department of Navarre Government
I.20	Middle	Female	n/a	n/a	Member of Nueva cultura del agua NGO
I.21	Middle	Male	n/a	n/a	Manager of Artajona cooperative
I.22	Middle	Female	n/a	n/a	Technical head of the CPAEN Ecological Agriculture Council of Navarre
I.23	Middle	Male	Northern area	Part time	Worker of a city council, councilor of agriculture
I.24	Young	Female	n/a	n/a	Member of a consumption group
I.25	Young	Male	n/a	n/a	Member of a consumption group
I.26	Middle	Male	n/a	n/a	Technician of UAGN agrarian union in Navarre
I.27	Middle	Male	n/a	n/a	Technician of EHNE agrarian union in Navarre
I.28	Middle	Female	n/a	n/a	Member of a traditional irrigation community
I.29	Middle	Male	n/a	n/a	Agrarian economist professor at the University of Navarre

<35: Young; 35-55: Middle-aged; >55: Old

III. Focus groups template

Focus group discussion session was divided in two terms. In the first term the lead author provided a brief presentation of the results about farmers' valuation of NCP. The aim here was to check whether participants agreed with the results. She reminded the methods used and the questions asked, as well as the different types of farmers participating in the case study. A discussion about those results followed. Specially, we wanted to understand the reasons of some services being highly valued whereas others were more disregarded. Then we discussed which factors (e.g. age, policies, and technology) might influence their visions about NCP valuation.

We made a break where those conversations continued in a more informal way. In the second term of the discussion, NCP valuation results were presented aggregated by groups of farmers. Then we asked focus groups participants to guess which type of farmers corresponded with the different bundles of values about NCP. Results were then presented and contrasted with their guess, as a way to open up the discussion about the underlying reasons for such results. Finally, we concluded and discussed how such values and groups of farmers will evolve in the future.

IV. Participants in Artajona focus group

The following Table describes the participants' profiles of Artajona focus group. Farmers were selected according to time invested in agriculture, type of crops, management approach, gender and age.

	Age	Gender	Area/zone	Profile
FG1.1	Young	Male	Artajona	Large-scale intensive
FG1.2	Old	Male	Artajona	Large-scale intensive
FG1.3	Young	Male	Mendigorria	Medium-scale organic
FG1.4	Old	Male	Artajona	Small-scale diversified
FG1.5	Middle	Female	Artajona	Large-scale intensive
FG1.6	Old	Male	Artajona	Small-scale diversified
FG1.7	Middle	Male	Artajona	Large-scale intensive
FG1.8	Young	Male	Mendigorria	Medium-scale organic
FG1.9	Old	Male	Artajona	Small-scale diversified

V. Participants in Miranda de Arga focus group

The following Table describes the participants' profiles of Miranda de Arga focus group. Farmers were selected according to time invested in agriculture, type of crops, management approach, gender and age.

	Age	Gender	Area/zone	Profile
FG2.1	Middle	Male	Peralta	Medium-scale cereal intensive
FG2.2	Middle	Male	Olite	Medium-scale vine and cereals
FG2.3	Middle	Male	Miranda de Arga	Small-scale diversified
FG2.4	Middle	Male	Miranda de Arga	Small-scale diversified
FG2.5	Middle	Male	Miranda de Arga	Small-scale organic
FG2.6	Old	Male	Miranda de Arga	Small-scale diversified
FG2.7	Young	Male	San Martin	Small-scale organic
FG2.8	Middle	Female	Peralta	Medium-scale organic